

Basic fibroblast growth factor modulates cell cycle of human umbilical cord-derived mesenchymal stem cells.

ABSTRACT

Background: Mesenchymal stem cells (MSC) have great potential in regenerative medicine, immunotherapy and gene therapy due to their unique properties of self-renewal, high plasticity, immune modulation and ease for genetic modification. However, production of MSC at sufficient clinical scale remains an issue as in vitro generation of MSC inadequately fulfils the demand with respect to patients. Objectives: This study has aimed to establish optimum conditions to generate and characterize MSC from human umbilical cord (UC-MSC). Materials and methods: To optimize MSC population growth, basic fibroblast growth factor (bFGF) was utilized in culture media. Effects of bFGF on expansion kinetics, cell cycle, survival of UC-MSC, cytokine secretion, expression of early stem-cell markers and immunomodulation were investigated. Results: bFGF supplementation profoundly enhanced UC-MSC proliferation by reducing population doubling time without altering immunophenotype and immunomodulatory function of UC-MSC. However, cell cycle studies revealed that bFGF drove the cells into the cell cycle, as a higher proportion of cells resided in S phase and progressed into M phase. Consistent with this, bFGF was shown to promote expression of cyclin D proteins and their relevant kinases to drive UC-MSC to transverse cell cycle check points, thus, committing the cells to DNA synthesis. Furthermore, supplementation with bFGF changed the cytokine profiles of the cells and reduced their apoptotic level. Conclusion: Our study showed that bFGF supplementation of UC-MSC culture enhanced the cells' growth kinetics without compromising their nature.

Keyword: Mesenchymal stem cells; bFGF; Cell cycle.